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ABSTRACT

The Coping Strategies Inventory for Statistics (CSIS) is designed to identify beginning statistics students with non-facilitative test-taking and study-coping skills. The self-administered CSIS consists of directions followed by two scenarios. The student reads each scenario, decides how he or she would react to the situation, and rates each of the coping strategies on a scale of 0 to 9 as "not at all characteristic" or "characteristic" of himself or herself. The first scenario addresses study coping skills, and the second addresses test-taking coping skills. The CSIS was piloted on two undergraduate introductory statistics classes in the College of Education at the University of Alabama in the fall of 1988. A total of 45 students (5 males and 40 females), representing 20 different majors, took the inventory. The CSIS was administered during the last class meeting before the fall semester final exam and again (in a slightly modified form) before the first exam of the spring semester. Factor analysis indicated that the CSIS has reliability, demonstrates evidence of validity, and is appropriate for its stated use. The CSIS is provided. (TJH)

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Coping Strategies Inventory for Statistics

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Introduction

Many students entering an introductory statistics course feel a certain amount of anxiety about the course. The word "statistics" conjures up something foreign and foreboding. If the instructor could identify the students who are prone to anxiety, she or he could provide some strategies for using this anxiety constructively.

Definition of Construct

Anxiety has been defined as "an emotional state with the subjectively experienced quality of fear or a closely related emotion" and as "feelings of uncertainty and helplessness" (Endler & Edwards, 1982, p. 39). A coping behavior is a "specific cognitive and/or behavioral response" used to manage these feelings (Patterson, 1987, p. 167).

Coping Strategies

Coping strategies exist in every aspect of our lives. Some of these are helpful; others are not. The coping strategies used in this inventory were developed from a search of the literature. Much of the anxiety in a statistics course is actually test-related anxiety, therefore the coping strategies applicable to general test anxiety apply in statistics also. Coping strategies fall on a continuum from facilitative to debilitative (Hollandsworth, Glazeski, Kirkland, Jones, & van Norman, 1980; Crowley, Crowley, & Clodfelter, 1986). This continuum can be applied to many different coping strategies. For the purpose of

this inventory the following coping strategies were identified: 1) internal dialogue (Hendel & Davis, 1978; Sime, Asnorge, Olson, Parker, & Lukin, 1987); 2) behavioral acts (Meichenbaum & Butler, 1980); 3) focus of attention (Holroyd, 1986, Wine, 1980); and 4) responsibility for failure (Geen, 1980). These four coping strategies are applied to two areas: test-taking skills and study skills.

Purpose

The Coping Strategies Inventory for Statistics (CSIS) is designed to identify beginning statistics students with non-facilitative test-taking and study coping skills. Once these students are identified, help can be provided to enable them to develop facilitative coping skills. The inventory is intended to identify students with debilitating statistics ability and diagnose which coping strategies need improvement.

Organization of the Inventory

The CSIS if a self-administered test which can be used individually or in classes. The inventory consists of directions followed by two scenarios. The student reads each scenario, decides how he or she would react to the situation, and rates each of the coping strategies on a scale of "0" to "9" as NOT AT ALL CHARACTERISTIC or CHARACTERISTIC of himself or herself. The first scenario addresses the study coping skills, and the second addresses the test-taking coping skills. There are also two

global questions concerning anxiety which are used as a check of validity.

Sample

The Coping Strategies Inventory for Statistics was piloted on two undergraduate introductory statistics classes in the College of Education at The University of Alabama in the fall of 1988. A total of 45 students, 22 in a 9:30 AM class and 23 in a 6:00 PM class, took the inventory. Of the 45 students there were five males and forty females. The students were representative of 20 different majors, with only 1 education major in the entire sample. The inventory was administered for the first time during the last class meeting before the final exam. The inventory was modified slightly and administered before the first exam of the Spring semester 1989. This allows the instructor to use the results earlier in the semester to help students have a more positive experience in statistics. Based on the pilot study, the inventory was revised. The revised inventory was administered to four undergraduate classes and to two graduate classes in introductory statistics. The sample was composed of 39 graduate students and 78 undergraduates. The samples were taken in intact classrooms and were not random samples.

Standardized Directions

Each student should be provided with an inventory, an answer sheet, and a number two pencil. The administrator should have each student record her or his name, sex, and student number on

the answer sheet. The administrator should assume that each student knows how to bubble in the answers on the computer scoring sheet. The administrator reads the directions, which consists of the first three paragraphs, and he or she confirms that each student understands what he or she is to do. Then the students are to read each scenario and respond according to the directions. There is no time limit, but 20 minutes should be ample time to complete the inventory.

Derivation of Scores

The questions marked with an asterisk in the CSIS in Table D are reverse keyed and must be recoded before scores can be derived. There is a Scale 1 score referring to study coping strategies and a Scale 2 score referring to test-taking coping strategies. For Scale 1 the points are totalled for Items 1 to 20 inclusive. For Scale 2 the points are totalled for Items 21 to 40 inclusive.

Interpretation of Scores

For each of the two scales the possible scores range from "0" to "180" with a "0" indicating a complete lack of coping strategies and "180" indicating a very high level of coping strategies. A student with a score of "130" or higher on a scale is able to cope well in that area. A score between "110" and "129" might indicate remediation in certain areas. A score below "110" is indicative of a need for training in the use of coping strategies.

General Rules for Scoring

Scoring may be done by hand or by computer. The pilot study was scored by computer and analyzed using SPSSX. Some of the items are reverse keyed, necessitating some manipulation of the data before analysis. Once the recoding is done, the score for each scale is the sum of the points for the items in that scale. Scale 1 includes Items 1 to 20; Scale 2 includes Items 21 to 40. The total for each Scale gives the raw score for that scale. The Standard Error of Measurement for Scale 1 is 11.63, and for Scale 2 it is 9.53.

Use of the Test Results

The CSIS is intended to be used only to identify students who do not cope well with statistics. The results can be used to help students develop better coping skills.

Item Analysis

After the pilot study was completed, an item analysis was done on the CSIS. In the course of the item analysis the following statistics were examined: the item means and standard deviations, the Scale-means-if-item-deleted, the alpha-if-item-deleted, and the correlations with global questions 1 and 2 and with final grade point average. These statistics and the items themselves were examined by a panel of people in a graduate level psychometrics class. The decision was reached to drop one question from Scale 1 and one from Scale 2.

Validity

The content validity of the Coping Strategies Inventory for Statistics was established in two ways. First, the construct and its components were identified through a search of the literature on stress, anxiety, coping, and statistics. Items were then developed and assessed by the author and an expert in the field of test development. Second, the inventory was designed according to a Table of Specifications.

Criterion validity was also established by correlating the results of the inventory with the final grade point average in the course and with the responses to two global questions on how well the person coped with studying for and taking a statistics test.

The validity coefficients were obtained from the correlations between the two global questions and the score from Scale 1, Scale 2, and the Total Score. On Scale 1 the validity coefficients were .3135 for the first question and .5402 for the second question; on Scale 2 the coefficients were .6067 and .6308. When using the Total Score the coefficients were .4908 and .6316. These coefficients reflect the combined sample of undergraduates and graduates.

The final grade point average correlated with Scale 1 with a coefficient of .4558. When correlated with Scale 2, the final grade point average had a correlation coefficient of .5911.

The global questions are better predictors than the final grade point average in the course.

Reliability

Reliability was determined through internal consistency. The analyses were done on data from the sample described earlier. Using the entire sample, the alpha for Scale 1 was .7920, for Scale 2 alpha was .8061, and for the Total Score alpha was .8821. All of these values represent an improvement over the original alpha values from the original sample.

Purpose of Factor Analysis

In order to determine whether or not the inventory actually represented the four coping strategies set out in Chapter 1, a factor analysis was done on the data from the sample of 117 students. A factor analysis should indicate the existence of the underlying dimensions and identify the items which load on them. Four factors were originally anticipated: internal dialogue, behavioral acts, focus of attention, and responsibility for failure.

Eigen Values

Forty items on the revised version of the CSIS were used for the factor study. An examination of the eigen values for the CSIS showed a large break in the values after 1, 3, and 12 factors. (See Table 1) Upon examining the possibilities, three factors were chosen.

Table 1

Eigen Values

8.464736	1.164836	.572441	.289949
3.828786	1.087505	.532610	.257588
2.484975	.970216	.497289	.247966
1.926412	.861455	.467418	.210845
1.741877	.848225	.448389	.186333
1.641234	.783891	.430240	.151363
1.432772	.723228	.397712	.142440
1.330498	.697616	.379069	.128328
1.291888	.662519	.337698	.114470
1.242459	.614580	.307015	.101130

Factor Loadings

The factor loadings were studied using the principal components method, using a Varimax orthogonal transformation solution, and a Promax oblique solution using all of the items. The Promax rotation provided the best solution. Factor I had a loading of 17, Factor II had 14, and Factor III had 9. After an examination of the items which fell under each factor, it was decided to name the factors as follows: Factor I - mental or cognitive aspects; Factor II - physical aspects; and Factor III - focus of attention. These factors are quite similar to the four factors originally anticipated. Table 2 lists the items by the factor on which they loaded.

Table 2

Factor Loadings

	Factor I Cognitive Aspects	Factor II Physical Aspects	Factor III Focus of Attention
Items	4	1	2
	5	7	3
	6	9	8
	17	11	10
	22	12	18
	23	13	19
	24	14	21
	25	15	26
	27	16	30
	28	20	
	31	29	
	32	34	
	33	35	
	36	38	
	37		
	39		
	40		

Intercorrelation Matrix

The interfactor correlations ranged from -.27944 to .25046. These very low correlations indicate that there are in fact three distinct factors with little or no relation to each other.

Variance

The variance accounted for by the three factors in the Promax rotation was .4248. Factor I accounted for 7.064726, Factor II accounted for 5.588598, and Factor III accounted for 4.407734. The total variance accounted for was determined by summing the values for the three factors and dividing by the number of items (40). When thirteen factors were considered, the total variance accounted was over .70.

Conclusions and Recommendations

The results of the analyses indicate that the CSIS has reliability, demonstrates evidence of validity, and is appropriate for its stated use. There is still a lot of work which can be done on the CSIS. It has not yet been used at the beginning of a semester to identify students who need intervention. Once this is done it could be evaluated in terms of its usefulness. The large drop in Eigen values between one factor and two factors might indicate trying only one factor and reassessing the results which would provide evidence for unidimensionality. This would also mean collapsing the two original scales into one instrument. A larger sample size might change the results of the factor analysis. Additional studies might also address the techniques to be used for intervention with those students exhibiting debilitative coping strategies.

Appendix A

Coping Strategies for Statistics (Revised)

Directions

Below you will find two scenarios. In each of these scenarios imagine that you are the student. Think about the following questions: what is your initial reaction to the description in the scenario; how would you personally cope in each situation; what action(s), if any, would you take?

Next, read the descriptions for each of the possible coping strategies. Respond by asking yourself if each of these coping strategies is CHARACTERISTIC of you or NOT AT ALL CHARACTERISTIC of you. You are to use a scale of 0 - 9 when responding to each of the possible strategies. A response at the lowest end ("0") of the scale indicates that the coping strategy is NOT AT ALL CHARACTERISTIC of you. A response at the highest end ("9") of the scale indicates that the coping strategy is DEFINITELY CHARACTERISTIC of you. A response "2", "3". ..."8" indicates the extent to which you believe that the coping strategy is characteristic of you at some point between NOT AT ALL CHARACTERISTIC and DEFINITELY CHARACTERISTIC . Each of the coping strategies is prefaced by a number, beginning with number 1. Read each statement and mark the appropriate response from "0" to "9" for the corresponding number on the answer sheet.

Rate each of the following coping strategies by filling in a circle with a number from "0" to "9" on the answer sheet to indicate the extent to which you believe it is characteristic of your behavior in that situation.

Scenario 1

You are a student in a statistics or research class, and there is an exam today. Since the semester began, you have studied hard learning statistical concepts and formulas and working many problems. As you approach the building for the exam, you are thinking about the many hours of work you have devoted to this course and how you have gone about learning the material.

Rate each of the following statements by filling in a circle with a number from "0" to "9" on the answer sheet to indicate the extent to which you believe it is characteristic of your behavior in that situation.

NOT AT ALL CHARACTERISTIC **0 1 2 3 4 5 6 7 8 9** **DEFINITELY CHARACTERISTIC**

While studying, you ...

1. kept reminding yourself of all the things you needed to do after studying.
2. told yourself you would understand the material if you worked calmly.
3. told yourself to concentrate on the concepts and work the study problems.
4. told yourself you could not understand the material.
5. thought the other people in the class were smarter than you.
6. thought the time and effort spent studying would pay off and that you would do well on the exam.
7. were always thinking about your plans for the weekend.
8. listed the major concepts for the exam and reviewed your notes and problems.
9. spent a lot of time getting ready to study.
10. devoted a regular time at least three or four days a week to this class.
11. were easily distracted.
12. watched television.

13. were in a calm atmosphere.

14. "studied" for more than one course at a time.

15. concentrated only on the concepts the professor indicted were important for the exam.

16. usually put off studying for an exam until the day before the exam.

17. skimmed through the text and could not make any sense out of it, so you did not study.

18. made note of questions to ask the professor in class.

19. made note of questions to ask the professor outside of class.

20. stayed with every concept until you thought you understood it.

Scenario 2

You are a student in a statistics or research class, and it is time for an exam. You have studied hard since the semester began and examined the statistical concepts covered in the course. You have your calculator and list of formulas ready to use during the exam. The professor hands you your paper; you read over the exam and start to work.

Rate each of the following statements by filling in a circle with a number from "0" to "9" on the answer sheet to indicate the extent to which you believe it is characteristic of your behavior in that situation.

NOT AT ALL CHARACTERISTIC **0 1 2 3 4 5 6 7 8 9** **DEFINITELY CHARACTERISTIC**

As you are working, you tell yourself ...

21. to stay calm and concentrate.

22. you can figure out anything that you are asked to do.

23. that you will not be able to do the problems.

24. to work as much as you can on each problem so that you can get partial credit.

25. that you are going to fail the exam.

26. to do your best and see what happens.

While you are working, you ...

27. focus on one problem at a time.

28. worry about the remainder of the test while working on problems.

29. think about what you did last night instead of studying.

30. work a problem and recall similar study problems.

31. notice other students seem to be working more rapidly.

32. find yourself in an uncontrollable state of panic.

33. skip difficult problems, do the easy problems, then go back and do the hard problems.

34. check your calculations to make sure they are right.

35. read each problem twice and check the answer.

After the exam you ...

36. know you did not prepare well enough.

37. blame the teacher for not explaining clearly.

38. did poorly because the exam was at an odd time.

39. did poorly because the professor made the exam too difficult.

40. did well because of your hard work.

There are two final questions.

41. How well do you cope with taking a statistics exam?

NOT WELL AT ALL 0 1 2 3 4 5 6 7 8 9 VERY WELL

42. How well do you cope with studying for a statistics exam?

NOT WELL AT ALL 0 1 2 3 4 5 6 7 8 9 VERY WELL

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